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526 staff play. The object of the game is to see which can keep up longest the continual strain upon the muscles of the arm, and ultimately strike the staff from the hand of the other."

HYGIENE: DISEASES AND THEIR CURE

515 Most of the Indians keep themselves very clean and take a bath twice a day in the river adjoining their settlement. As they wear but little clothes this is a very simple operation with them; they keep their body cleaner than do the lower class of the Ladinos, or of the white race in Europe, where the clothes are frequently the main source of dirtiness.

514 When the Indian goes to stool he always takes to the water, drifting down the river until he comes to a secluded spot, where he can perform this operation in privacy. When finished he cleanses the body with water.

515 The presence of dogs and pigs in the huts is responsible for the great quantity of fleas to be found there. In spite of the great care devoted to the hair, the latter is frequently full of vermin, and it is not an uncommon occurrence to see at the villages rows of women picking off one another's lice and crushing the troublesome insects between the teeth—a most disgusting sight.

● 164 MALARIA.—A swelling of the spleen and anemia are common enough and are undoubtedly the result of malaria (M.: *wrih;* T.: *ware, warai;* P., U.: *yama, yamah*),[44] which is endemic in the lowlands, although rarely fatal. The transmitting agent of malaria is a mosquito of the genus *Anopheles*, which is very common.

751 For malarial fevers infusions from the bark of certain trees are administered, especially that of the copalchí (*Cinchona* sp.). Instead of sudorific bush medicine, quinine is also administered nowadays. The fever or lemon grass (*Andropogon nardus* L.) is also used for this purpose. The sudorific is followed by a steam bath. The stricken person is enveloped in tunu blankets, and water is thrown on some large heated stones placed at his feet; he then inhales the thick vapor or fumes produced thereby. This part of the treatment is excellent, for it induces perspiration; but as the patient is then taken to the riverside and forced to take a cold bath pneumonia is often the result.

Among the Sumu the patient is carried to one of the numerous hot springs (*daka*) which abound in their territory, and immersed therein, or he is buried up to the armpit in the hot sand at the edge of the pool.

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[44] These names were formerly used by both Miskito and Sumu as a general term for most other maladies, but nowadays the Miskito have adopted the word siknis (Engl. "sickness") in the latter sense.

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SKIN INFECTIONS.—Cutaneous infections are very common in certain regions, a fact already recorded by Exquemelin (French ed.: II, 277), who visited the Miskito of Cabo Gracias a Dios; they are the result of ignorance of the most elementary principles of hygiene.

A certain skin disease, which starts by a burning or swelling of flesh, is said to be caused by the urine of an insect, which, like the disease itself, is called *mustukra* by the Miskito.

A specific ulcer, resembling cancer, and known locally by the name "bay-sore" (M.: *lasa krûisa* "the devil is boring"; S.: *pilau, tamak*), is sometimes caught by Indians and Negroes. It breaks out on face, arms, and legs, and is generally attended with very acute pain. It is cured by powerful caustics, or applications of a corrosive nature. The common ulcer, abscess, or carbuncle is called *yukri* (M.) and *suru* (S.).

Various other bad skin diseases may be found in certain regions; they are known by various names (M.: *yats, kliñkliñ, kuswa-dûya;* S.: *una*).

A cutaneous affection, sometimes taken for leprosy (which is rarely met with), is very common among both tribes. It is known by the names *bulpis* among the Miskito and *mara* among the Sumu; the Spanish-speaking Central Americans call it "bienteveo," "carate," and "mal del pinto." It occurs in white, red, and black blotches; for that reason the Ladinos refer derisively as *gente pintada* "painted people" to the ones afflicted with this disease.

Ringworm (M.: *sus, sihiri, bulpis twaknira;* S.: *mara pdû, mara titis*) is also met with among the Indians. Small warts (M.: *sisrama;* S.: *titismak*) also occur on the hands.

Painful sores may also be caused by the jiggers or chigoes (*Sarcopsylla penetrans*), a sort of flea, which is very common during the dry season but disappears gradually at the beginning of the rainy period. This insect lives on the ground and is especially common around the dwellings where pigs are allowed to roam. It burrows itself under the skin and toenails of man and animal to deposit its eggs. If the latter be taken out immediately with a disinfected needle or the point of a knife, the wound will heal without further care.

Minute ticks cover every bush during the dry season. They fix themselves to the body of man and animal and bury their head in the skin. Sometimes they cause painful inflammations.

YUMU, OR STOMACH ACHE.—This state of ill being is very common among the Miskito and appears to be merely some sort of indigestion due to overeating. The Indians believe that it is caused by the spirit of an animal which has entered the body of the sick person. This may have taken place by eating a piece of the animal in question, or by being scared at the sudden appearance thereof, while being out in the bush. Thus if the agouti (kyaki) has caused the ill the latter

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will be known as *kyaki yumu-ka*. The Sumu have apparently taken this belief from the Miskito, and they have no distinctive name for the ill; the Rama of Nicaragua call it *yakuki*.

The sukya cures this illness after its source has been revealed to him in dreams, for the treatment differs slightly according to various animals which have caused it. But in all cases the belly of the patient is strongly massaged with animal grease (also vaseline, coconut oil), while the sukya keeps on continually a low whistle in order to induce the spirit to depart. Among the Christianized Miskito there are also some people who heal *yumu* by similar methods; they are known as *yumu yabaka uplika* "people curing yumu."[84]

Women *enciente* may occasionally suffer from *kwihra yumu-ka* "pregnancy yumu"; the child is supposed to die then invariably, unless the sukya applies a treatment.

OTHER INDIGENOUS DISEASES.—Dysentery (M.: *taldura;* S.: *ba-pau*) occasionally appears in the form of an epidemic; it is generally cured by the administration of an infusion from the bark of the nance tree (*Byrsonima crassifolia* H. B. K.).

To cure diarrhea (M.: *byara plapaya;* T., P.: *ba lanin;* U.: *bawas lanaka*), the favorite remedy is an infusion prepared by boiling the bark of the mountain guava tree or the seed of the zapote or monkey apple. The Sumu also boil the rootstock (M.: *labu;* S.: *sara*) of the black or Ulwa banana.

According to the investigations carried on by the Rockefeller Foundation, hookworm is found on about 75 per cent of the Indian population living around Matagalpa. There is no doubt that it is also common among the Indians of the Mosquito Coast. Hookworm is seldom fatal, but there is progressive anemia and frequently interference with mental and physical development, causing occasionally premature death.

Children especially seem to be infected with intestinal parasites, as may be seen from their color and their enormously swollen belly; this is largely due to their habit of eating earth, charcoal, and the like.

Rheumatism (M.: *kyaia lâiwaya, dusa lâiwaya;* S.: *wakal dalanin, wakal dalanaka*) is supposed to be caused by thorns or fishbones which have been introduced into the flesh by evil spirits. The sukya pinches and kneads the afflicted spot, then makes a small incision with a glass splinter and, applying his mouth to the wound, he sucks a little and finally produces a prickle or bone, which he had carefully hidden between his teeth.

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[84] Ziock (162) gives *yumuk* as the Miskito name for a native doctor curing with medicines. In the Carib dialects of Surinam and adjacent regions *yumu* is the name for some sort of spirit.

[i.e. yumu, or stomachache, see cat. no. PA119-20 – Analyst]

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Wickham (b: 160–161; c: 205) states that the Ulwa used to cure pains in the limbs by flogging the aching part with a kind of nettle, until the skin became raised in bumps.

A disease of the eyes, perhaps trachoma, called *ūkri bāikan* by the Miskito, is prevalent; it does not produce total blindness, but causes great pain. Foreigners appear to be immune to it.

Venereal diseases, as syphilis (M.: *mārmanka;* S.: *pildū*) and gonorrhea (M., S.: *iskadora*), are only met with in the larger villages at the coast. Anthropologists and the medical world seem, however, to agree now that syphilis is of American origin.

Yellow fever likewise is undoubtedly of New World origin, and was formerly endemic in certain parts of the Central American lowlands. In the sparsely populated country under consideration, however, no authentic case of yellow fever has been recorded. Perhaps the transmitting agent, a species of mosquito (*Stegomyia fasciata* syn. *Aëdes* sp.), is absent. Black water fever is also unknown. Leucorrhea is, however, very common. Indians suffer seldom from hemorrhoids (M.: *slabla dāiwaya;* S.: *sarani putulnin, saraka putulnaka*), which swelling is prevalent among whites residing in the country.

FOREIGN DISEASES.—Europeans have introduced among the Indians a number of distressing maladies formerly unknown to them, and against which they had not the slightest immunity. Although strong and robust, the Indians are especially subject to infections by the germs of diseases generated by large communities.

Epidemics of our common catarrh (M.: *syahka;* T., P.: *ohdana;* U.: *nattuk isanaka*) have occasionally caused great havoc among the Indians of the interior.

Whooping cough (M.: *ikya;* S.: *duk*) appears occasionally as an epidemic among children, whereby many of them die.

Influenza or grippe also occurs periodically as an epidemic. It seems to have been brought to the country for the first time in 1807–08 by some Miskito returning from the logwood and mahogany camps of British Honduras. Consumption is also found sometimes, especially among the Sumu.

Measles and smallpox were brought to the New World by the first conquistadores and facilitated the subjugation of the Indians. Epidemics of measles (known by the Spanish name "*sarampion*") are responsible for many deaths; this disease was already observed at Cabo Gracias a Dios among the Miskito during the latter half of the seventeenth century (Exquemelin, French ed.: II, 277). Smallpox has on different occasions decimated entire villages, but since the middle of the nineteenth century has not appeared on the Mosquito Coast. Wickham (b: 204–208) gives an account of the last epidemic of Asiatic cholera which swept the country in 1867 and 1868.

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ralization can be directly applied to diets in the tropics: the galaxy of nutritional factors are determined by the local situation and the food habits of the people.

The same can be said of tropical infectious disease. The variety of vectors, their ecological relations to circumstances determined by altitude, rains, swamps, climate and vegetation limit disease entities to special regions even though many diseases occur throughout the world. It must be remembered that to the diseases generally present among people are added those which are peculiar to a new environment and that modifications of a disease can take place. For instance, whooping cough is a serious disease attended with a high mortality rate in Central Nicaragua, whereas scarlet fever produces a mild disease often unrecognized. Whether the host or the organism is responsible for such a condition is not known and the problem of host and parasite interrelationships becomes a complex one.

THE MOSQUITO AREA: THE LOCAL SITUATION

The vast region on the Atlantic side of Nicaragua and Honduras is known by the name of Mosquito coast. It is inhabited buy four different tribes of Indians: The Miskito, the Suma (Sumu), the Paya, and the Rama. In some localities the Miskito, often incorrectly called Mosquito, have a considerable admixture of Negro blood and, for this reason, are in some places called Zambos. The other three tribes, however, are practically of pure Indian blood. In earlier times, the western region of the Mosquito coast was occupied by the Matagalpa Indians, whose language extended over a large area in Nicaragua and Honduras, but has been extinct for nearly half a century. However, a dialect of its is spoken to this day by the older inhabitants of the Salvadorean villages of Cacaopera and Lislique. Today the Indian languages of the area are somewhat interrelated, especially Matagalpa, Miskito, and Suma; Paya is an unrelated language.

The Miskito and small isolated bands of Suma Indians inhabit the eastern side of Honduras and Nicaragua. They are found from the Río Tinto (lat. 15° 50′ N.) to Río Punta Gorda (Lat. 11° 30′ N.). The villages are located chiefly along the banks of the rivers as far up as the headwaters within the jungle proper. The Suma Indians are found primarily in the interior; they are somewhat uncommunicative, but cooperative. The Miskito are self-sustaining and at times derive additional income from labor with fruit companies, mining enterprises and rubber collecting agencies. Today they play an important part in the wild rubber collection program.

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in regards to age groups whereas this one concerned itself with infants where anemia was to be expected. Furthermore Shattuck was able to exclude malaria as a cause of anemia. 146

Blood smears were examined and the significant findings were a slight achromia and variation in size and shape of the red cells, and microcytosis characteristic of chronic hypochromic microcytic anemia commonly associated with iron deficiency in the body.[51] So far then in infants and early childhood the prevalent deficiency is an iron lack which was found to be so not necessarily on clinical evidence but on laboratory investigation.

Hypochromic anemia. The relatively low iron content of milk (1.8-2.3 mg. 1 liter Fe) [52] accounts for the presence of anemia in early infancy and subsequently a diet, early in life, not rich in iron may not overcome the depleted iron reserves. To this is added the anemia sustained by the effects of infection and intestinal parasitism. Since the more severe anemias occur in those subjects with hookworm disease an iron balance study was undertaken. 146 164

Balance study of four subjects with Necator Americanus infestation: Since the demonstration by Stiles,[54] Harris, [55] and others, that hookworm infestation in the United States in associated with anemia, the relationship of cause and effect the syndrome has received attention

Recently Rhoads, Castle, Payne and Lawson[56] have advanced the view that the anemia resulting from hookworm infestation is due to blood loss through the bowel. This is based on the fact that the worms with their hooks cause minute hemorrhages in the bowel wall, but they have stated as have other observers[57], [58] that although there is a slow hemapoietic response to iron therapy during infestation a dramatic response to treatment occurs only when it is administered after the removal of the worms. The assumption that this is a blood loss anemia

[53] Peterson, W. H., and Elvehjen, C. A. The Iron Content of Plant and Animal Foods. Jour. Nutrition, 1931, *4*, 419.

[54] Stiles, C. W. Report upon the prevalence and geographic distribution of hookworm disease. U. S. Govt. Print. Off., U. S. Public Health Service Hyg. Lab. Bull., 1903, *10*.

[55] Harris, H. F. Ankylostomiasis, the most common of the serious diseases of the southern part of the United States. Amer. Med. 1902, *4*, 776.

[56] Rhoads, C. P., Castle, W. B., Payne, J. C., and Lawson, H. A. Observations on the etiology and treatment of anemia associated with hookworm infection in Puerto Rico. Medicine, 1934, *13*, 317.

[57] Rotter, W. Ueber die histologischen Veränderungen des Dunndarms bei Ankylostomiasis. Virchows Arch. of path. Anat. 1931, *280*, 587.

[58] Rhoads, C. P., and Castle, W. B. Observations on the etiology and treatment of the anemia of hookworm disease in Porto Rico. Jour. Clin. Invest. 1932, *11*, 909.

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is based on the blood picture, bone marrow examination and on the fact that the effect of iron therapy was moderate until after the removal of the worms. The fact that live extract exerted no particular effect was interpreted by Rhoads and his associates to support their view.

The assumption that blood loss is the cause hookworm anemia is a good one since it is obvious that the worm draws through its gastro-intestinal tract a fairly copious amount of blood. In fact, much of the blood may pass through the worm in an unused condition. On the other hand it is of interest to note that the degree of anemia and the number of worms present in an individual cannot be correlated.[59], [60] Actually it has been found that a small number of parasites can cause a profound anemia. Whipple,[61] furthermore, has found weak hemolytic factors in hookworms which has suggested the chronic effects of a hemolysin.

The morphological characteristics of the blood cells in hookworm anemia are not those found in hemolytic jaundice. There is besides this consideration the report of De Langen[62] which expresses the view that hookworms secrete a substance toxic to bone marrow. It may be that a variety of factors aside from blood loss exist which are responsible for the anemia. So far no one has attempted to determine iron utilization in subjects with hookworm infestation, a feat which today could be studied to advantage with radio active iron. Our studies, however, were carried out using the classical method of iron balance in which certain errors may occur.

The iron balance was performed in four subjects with hookworm infestation. The procedure used was that described by Farrar[63] and the iron assays of food and feces were performed by the method of Pijoan and Elkin.[31] The only hematological inquiry was the hemoglobin determination in order to ascertain the response to various intakes of iron. The subjects were boys, two of them of 8 years of age, one of 10 years and another of 12 years. As far as could be ascertained all

[59] Smillie, W. G. Studies on Hookworm infection in Brazil. Rockefeller Inst. Monograph, 1922, *17*, 46.

[60] Rosenblum, M. B., and Malkowa, M. N. Zur Charakteristik der Anaemia bei Anchylostoma duodenale. Folia Haematol., 1928, *37*, 197.

[61] Whipple, G. H. The presence of a weak hemoglobin in the hookworm and its relation to the anemia of Uncinariasis. J. Expl. Med., 1909, *11*, 331.

[62] De Langen, C. D. Contributions to the toxic origin of the Anaemia and other symptoms with Ankylostomiasis. Trns. 5th Biennial for East. Assn. Trop. Med. London, 1924.

[63] Farrar, G. E. Jr. The determination of iron in biological material. Jour, Biol. Chem., 1935, *110*, 683.

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of them had untreated hookworm infestation of some duration. There was no method at our disposal to accurately determine the degree of infestation. The diet consisted chiefly of milk, bread, cheese, avocado, banan, vitamins and eventually ferrous sulfate supplements. The results are expressed in the following tables.

SUBJECT I

	Intake mg.	*Feces Fe Output* mg.	*Balance* mg.	*Hbg.* %	*Occult Blood in Stools*
1	7.31	7.40	— 0.09	7.4 gms.	None
2	7.42	7.40	— 0.02		None
3	7.21	7.40	— 0.19		None
4	7.46	7.50	— 0.04	7.38 gms.	None
5	7.33	7.31	+ 0.02		None
6	7.37	(*)			
7	7.56	7.49	+ 0.04		Trace
8	8.22	8.31	— 0.09		Trace
9	8.41	8.39	+ 0.02		None
10	8.30	8.30	———		
11	8.60	8.75	— 0.15		Trace
12	8.75	8.62	+ 0.13		None
13	8.80	(*)			
14	8.20	8.31	— 0.11	7.38 gms.	None
15	8.36	8.30	+ 0.06		None
16	8.41	8.46	— 0.05	7.36 gms.	

Total Balance in 16 days — 0.51

* Specimens lost.

SUBJECT II

	Intake mg.	*Feces Fe Output* mg.	*Balance* mg.	*Hbg.* %	*Occult Blood in Stools*
1	11.15	11.15	———		
2	11.20	11.21	— 0.01	6.0 gms.	None
3	10.40	10.38	+ 0.02		Trace
4	10.81	10.58	+ 0.23		None
5	9.68	9.72	— 0.14		None
6	10.41	10.46	— 0.05	5.8 gms.	Trace
7	10.28	10.30	— 0.02		None
8	9.34	9.36	— 0.02		Trace
9	9.82	9.79	+ 0.03		None
10	10.56	10.58	— 0.02		None
11	10.62	10.62	———		Trace

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12	10.84	10.83	+ 0.01	6.0 gms.	Trace
13	11.36	11.36	——		None
14	11.42	11.43	— 0.01		None
15	11.41	11.42	— 0.01		None
16	13.64	13.63	+ 0.01	6.12 gms.	None

Total Output Equals Intake Neg. Balance.

SUBJECT III

	Intake mg.	*Feces Fe Output* mg.	*Balance* mg.	*Hbg.* %	*Occult Blood in Stools*
1	18.75	18.76	— 0.01	5.16 gms.	None
2	22.41	21.06	+ 0.35		None
3	19.35	19.37	— 0.02		Trace
4	20.36	20.36	——		None
5	21.10	21.08	+ 0.02		None
6	20.34	20.36	— 0.02		Trace
7	22.10	22.09	+ 0.01		None
8	21.15	20.15	——		None
9	18.98	18.96	+ 0.02		None
10	19.26	19.25	+ 0.01		None
11	19.34	19.34	——		None
12	19.71	20.74	— 0.03	5.80 gms.	Trace
13	19.24	19.23	+ 0.01		None
14	19.49	19.47	+ 0.02		None
15	20.10	20.10	——		None
16	20.18	20.17	+ 0.01	6.0 gms.	None

Total Balance 0.38 mg.
0.0237 mg. per day

SUBJECT IV

Supplemental Iron Given (given 75 mg. $FeSO_4$ = 27.5 mg. Fe)

	Intake mg.	*Feces Fe Output* mg.	*Balance* mg.	*Hbg.* %	*Occult Blood in Stools*
1	36.41	36.38	0.03	7.12 gms.	No
2	37.42	37.39	0.03		tests
3	36.30	36.28	0.02		done
4	38.40	38.31	0.09	7.40 gms.	because
5	44.76	43.57	1.19		of
6	45.71	44.65	1.06		high
7	44.84	43.78	1.06	8.0 gms.	iron
8	44.73	43.66	1.07		intake

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9	45.12	43.11	2.01	
10	43.19	42.13	1.06	9.0 gms.
11	39.38	39.30	0.08	
12	38.40	38.31	0.09	
13	37.41	37.32	0.09	10.5 gms.
14	36.64	36.59	0.05	
15	38.52	38.45	0.07	11.5 gms.

Total Intake 9.11 mg. or 0.57 mg. Fe daily.

Since the amount of iron in urine is negligible and would indicate if anything in favor of negative balance no urinary excretion iron assays were performed. It is obvious from our study that a positive but slight (0.0237 mg.) balance is shown when the consumption of iron is in the neighborhood of 18 mg. iron intake a day, but it is known that during early life iron requirements are considerable and the drains upon the iron stores will then be the greatest. Exhaustion of iron stores takes place during the first year of life when the total blood volume is tripled and the total hemoglobin doubled.[64] A low iron intake at this time will bring about a depletion of the iron reserve. At the age when Necator infestation manifests itself the hemoglobin stores are often low or exhausted. It has been calculated by Heath and Patek that the average annual requirement of a 10 year hold child is about 0.152 grams or 0.04 mg. per day of absorbed iron (derived from a positive balance). It is obvious therefore that the iron utilization of 0.0237 mg. per day is quite insufficient, especially when the body stores are depleted. Thus, in Necator infestation more iron is required, and the administration of supplemental iron (75 mg. $FeSO_4 = 27.5$ Mg. Fe) brings about a positive balance where 0.57 mg. Fe are apparently absorbed daily. From subfindings it seems clear that the anemia of hookworm requires treatment with large doses of iron and it has been the clinical experience of others[66] that improvement takes place only with large doses of iron ammonium citrate and ferrous sulfate. On the other hand the hemoglobin increases 1/2 per cent per day if the worms are first removed.[66] These data presented here lead us to conclude that the explanation of anemia based entirely on blood loss from the bowel is an unsatisfactory one. Even though it may contribute to the anemia of Necator infestation, some other mechanism must play a role in sustaining the anemia. Whether the worms secrete a toxin which affects the hemopoietic system or a substance which forms unassimilable iron salts is a matter of conjecture and requires further inquiry. It has been noted that about fifty per cent of subjects with hookworm infes-

[64] Heath, C. W., and Patek, A. J., Jr. Anemia of iron deficiency. Medicine, 1937, *16*, 267.

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146 tation have chronic diarrhoea, some have glossitis,[65] occasionally leu-
164 copenia and lymphocytosis is observed. Reticulocyte counts usually were under 3 per cent and studies on platelets show them to be within normal limits. These findings indicate some unusual process in Necator hypochromic anemia.

Our own assays of the worms themselves reveal an iron content of only 1-2 mg. Fe per kilogram. It seems unlikely therefore that iron consumption by the worm plays a rôle in the anemia.

WORM INFESTATIONS

164 Because the writer is not a helminthologist the classification of
114 intestinal parasites is not a complete one and depended considerably on the aid given him by laboratory assistants. However, certain aspects of the subject are intriguing. Sandground[66] has pointed out that the data dealing with intestinal parasites can be collated in such a way as to throw light on the racial origins of some of the Indians and to bear witness to the invasion of Central American countries by alien races. Von Thering according to Sandground had demonstrated the value of testimony from the world of parasitism as an aid to zoogeography and paleozoology. For instance, in recognizing the close affinities between the tapeworms harbored by marsupials in South America and Australia, Zschokke[67] presented evidence of a phylogenetic relationship in their hosts. Metcalf[68] also demonstrated by studies on opalinid ciliates in Amphibia a genetic relationship between frogs of South America and Australia and brought out new facts which tended to corroborate hypotheses in geography dealing with land masses connecting now isolated continents. Using information on the history of certain infectious diseases, and their prevalence in certain races, Williams[69] used the host-parasite association as a means of studying racial relationships among American Indians.

[65] Ashford, B. K., King, W. W., and Gutiérrez, P. Report of the study and treatment of "anemia" in Porto Rico. Bur. Print. and Supplies, San Juan, 1904.

[66] Sandground, J. H. Consideration of relation of host specificity of helminths and other metazoan parasites to phenomena of age resistance and acquired immunity. Parasitology, 1929, *21*, 227-255.

[67] Zschokke, F. Die Darmcestoden der Amerikanischen Beuteltiere. Centralbl. f. Bakteriol. 1904, *36*, 51-62.

[68] Metcalf, M. M. Bull. 120, U. S. Nat. Mus. 1923: Smithsonian Misc. Coll. 1929, *81*, No. 18.

[69] Williams, H. U. The epidemic of the Indian of New England, with remarks on Native American Infections. Johns Hopkins Hosp. Bull. 1909, *20*, 340-349; 1616-1620.

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The solution of ethnological problems by the helminthological approach is not without its difficulties and as such is beyond the scope of this report. On the basis of Sandground's data the prevailing hookworm infection among pure blooded Indians should be *Ancylostoma duodenale* but where Negroes have settled and intermingled the infestation becomes dominantly *Necator americanus*. In the Coco Basis, where hookworms were introduced primarily by negroes, the infestation, as far as our observations permitted, was that of *N. americanus*.

It is of interest to note that onchocerciasis was not found in the Coco Basin even though the writer thought he had found two patients with this disease. The biopsy material was poorly prepared and there was some question as to the identity of the filarial worms. That the diagnosis was probably erroneous was further strengthened by the fact that *Simulium* flies transmitting this disease were not seen. However, the limited observations in searching for the fly were by no means thorough and do not exclude the possibility of their existence or that of the disease. It may be that in years to come when commerce between natives is increased the appearance of onchocerciasis may become an obvious clinical finding.

Cases of Schistosomiasis have been reported from Panama, Costa Rica and Yucatán but none have been reported from Guatemala[70] nor were we able to find any in Central Nicaragua. Even though *S. mansoni* and *S. hematobium* are of Ethiopian origin, the appearance of negroes in the Coco Basin did not introduce the disease and this fact is ascribed to the absence of the species of snails suitable for the larval development of the parasite.

The commonest worm infestations in the Indians of the Coco Basin were *Ascaris lumbricoides* and *Trichuris trichiura*. The former was common in communities which do not possess sanitary facilities and is contracted by ingesting eggs that are expelled in the feces. The latter, "whip worms", whose eggs are able to withstand adverse environmental conditions, almost to the same extent as those of Ascaris, was commoner than the former and the "pinworm" *Enterobius vermicularis* was frequently found. *T. saginata* and *T. solium* have been noted by others in the area studied but were not observed by us.

[70] Sandground, J. H. Helminthic infections in Guatemala in a Medical Survey of Guatemala. Carnegie Institution of Washington. 1938.

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Mixed Worm Infestation in 100 Children From Zapuca and Waspam (Coco Basin)
Nemathelminthes

Age of Child	*Number of Children Infected*			
	Ascaris Lumbricoides	*Enterobius Vermicularis*	*Trichuris Trichiura*	*Necator Americanus*
5—10	56	31	60	10
10—15	21	16	56	13

Trichuris trichiura infestation was common throughout the population. However, as the children become older, and among adults, there was a decreasing incidence of infestations, other than Trichuris, proportionate to the age of the individual. It is presumed that as age increases the subjects are more careful about their habits and the ordinary methods of re-infection are reduced.

757 164 In treating intestinal parasites, the Indians use numerous decoctions made from tree barks. As far as can be ascertained the brews act mainly as cathartics and are not, strictly speaking, vermicidal. The effect of violent catharsis is two-fold. First, there is the psychological effect of direct action of the therapeutic of reducing a swollen abdomen and the consequent relief from distension or constipation, and second, there is a diminution in the quantity of parasites, since many were removed by cathartic action. The Indians, however, prefer our methods for treating intestinal helminths and seek such treatment whenever available.

THE INFECTIOUS DISEASES OF THE COCO BASIN

Yellow Fever

164 Carter's investigations[71] have revealed that yellow fever was a disease brought to the New World from Africa. The first epidemic occurred in Yucatán in 1648. Since then numerous epidemics of yellow fever have been described; the distribution of the disease and dates of occurrence have been listed by Hirsch.[72]

As far as could be determined yellow fever has not been reported from the eastern coast and the interior of Nicaragua. Dr. Thaeler, at Bilwas Karma, has never seen a case in this area and other investigators have suspected it in this region but were unable to discover its presence.

[71] Carter, H. R. Yellow fever: an epidemiological and historical study of its place of origin. 1931. Baltimore.

[72] Hirsch, August. Handbook of geographical and historical pathology. 1883. Vols. I and II. New Sydenham Society, London.

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The mosquito, *Aedes aegypti*, the transmitter of the disease, is common in the territory but is apparently uninfected. Even in the listing of Hirsch there is no report of yellow fever in Nicaragua until 1868 and it is possible for geographical reasons that the disease failed to appear in the Coco Basin. According to Raynal[73] several outbreaks of yellow fever occured in nearby Guatemala (San José, 1859; Escuintla, 1868; Retalhuleu, 1881 and 1895), and this would confirm Hirsch's notation of yellow fever in Nicaragua in 1868.

It must be recalled that a high mortality occurs from yellow fever only when the disease appears in a relatively non-immune population or when the disease has been carried to immune territories. It is possible therefore that the disease, if present at one time, could be quiescent in certain areas for a period of years and since small numbers of travellers visit central and eastern Nicaragua, very few, if any, infective people enter the territory. With this in mind it would appear plausible to suppose that the vector insect has not had opportunity for obtaining the virus.

Plague

Although common in Europe during the 16th and 17th centuries, plague did not reach the New World until late in the 19th century, when it appeared for the first time in San Francisco, México, and other scattered territories. Plague is unknown in the Coco Basin and as a result presents no public health problem.

Cholera

The first pandemic of cholera probably started in Indian between 1817 and 1823 but did not reach the New World until between 1826 and 1837.[72] In 1837, according to Bancroft[74] the epidemics of cholera began to make their appearance through Guatemala and in other parts of Central America; in Nicaragua in 1855 it became a serious problem. In 1856 it crippled Mora's army in Nicaragua and continued its course. Walker's army was devastated by it.[74] The disease spread quickly throughout Central America and continued in El Salvador and Guatemala until near the end of 1857. It broke out again in Nicaragua in 1866 and continued in Honduras until 1871. In spite of the poor sanitary conditions today the presence of the disease has apparently

[73] Raynal, J. Annales de médicine et de pharmacie coloniales. 1932, *30*, 59, Paris.

[74] Bancroft, H. H. History of Central America, 1883, 1887, vols. 7 and 8. San Francisco.

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not seriously manifested itself. It apparently has not made its appearance in the Coco Basin and no knowledge of it can be found for the territory.

Smallpox

The exact date of the introduction of smallpox into the New World is not well known. In Mexico, Bernal Díaz[75] states "a negro was in the smallpox: an unfortunate importation for that country for the disease spread with considerable rapidity and the Indians died by the thousands"; this was in 1520. Since then there have been numerous ravages of the smallpox in various portions of Central America, however, there is no apparent history of the disease in the Coco Basin and if it did exist it would have been localized to a great extent to the smaller communities. The great outbreaks of smallpox in Costa Rica in 1862, in Guatemala and Honduras in 1883, was escaped by Nicaragua due to vaccination. Most of the visitors to the Coco Basin had already been vaccinated and this fact alone presumably supports the view that the disease is relatively rare in that territory.

Measles

The exact date of the introduction or recognition of measles in the New World is unknown. Hirsch states that measles was not recognized in Europe as a specific disease before the 18th century. Zinsser[76] on the other hand claims that measles was common among the natives of the New World in 1595 but that it was probably brought to America from the Old World. The disease has been a serious one to the Indians generally throughout Central America but for some particular reason it is fairly rare in the Coco Basin and only a few specific cases have been reported.

Typhus Fever

As far as can be ascertained typhus fever is extremely rare or does not occur among the Miskito Indians of the Coco. The disease apparently is of European origin but for some reason or other infected rats have not been introduced into eastern Nicaragua.

Whooping Cough

Whooping cough was introduced into America from Europe and caused the death of thousands of Indians and is particularly fatal to

[75] Díaz, Bernal. The true history of the Conquest of Mexico. Written in the year 1568. Translated by Maurice Keatinge: 1803. 2 vols. Salem and London.
[76] Zinsser, H. Rats, lice and history: 1935. Boston.

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them.[77] Sporadic epidemics of whooping cough have occurred in the Coco Basin and have always continued with considerable severity. Thousands of deaths from whooping cough were reported to the League of Nations in 1933 and 1934.[78] In the Coco Basin the children in a few villages have come down with this disease but because of the wide gaps between villages it has never spread entirely throughout the area. In short, the epidemics appear to become localized and have within the last 50 years decreased considerably in number. Thus, it can be said that considerable morbidity and mortality for whooping cough does occur at intervals of them but are localized in character.

Diphtheria

Diphtheria appears to be a relatively rare disease in the tropics; for instance, in the non-tropic areas such as Buenos Aires, the incidence per 100,000 persons was in 1929, 16.9; in Quebec, 23, and in Chicago in 1927, 13.8. In the tropic area in 1927 for Havana was 1.5; in 1928, 2.0; Guayaquil in 1930, 0.8; Veracruz in 1930, none; in Kingston in 1927-1929, none. Further north in Tampico the incidence was in 1930, 6.0; and in the Panama Zone in 1928, 9.9. Larsen[79] states that in the tropics diphtheria is a mild, seldom seen disease and rarely assumes epidemic proportions. This is of interest since Emerson[80] has shown that there is a significant difference in the cause and death incidence rates of diphtheria in various racial groups in New York City and he believes that the factor of race is the only one of importance which can be recognized. Be this as it may, the fact remains that today no case of diphtheria has been reported in the Coco Basin territory. This does not mean, however, that mild cases have not occurred since the disease might have been mistaken, if mild, for any of the upper respiratory diseases.

Pneumonia and Bronchial Pneumonia

At the time of our expedition through the Coco Basin we did not hear or not did we see any cases of pneumonia; however, we were in-

[77] Gann, Thomas, In an unknown land. 1924, New York.

[78] League of Nations Health Organization. Annual Epidemiological Reports, Geneva. For the year 1933, published in 1935; for the year 1934, published in 1936.

[79] Larsen, A. E. Variation of cosmopolitan diseases in tropical and temperate zones. Amer. Jour. Trop. Med., 1936, *16*, 91.

[80] Emerson, K. Future of program for tuberculosis control. Amer. Jour. Public Health, 1935, *25*, 707-711.

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164 formed that pneumonia and bronchial pneumonia did exist and that at
171 certain times the disease would occur especially among infants with a very high morbidity and mortality. Pneumonia is however more common in the highland tropics. For instance, in Guatemala, where the incidence is equal to that of México, it is more than double than that for Massachusetts. The disease in the Coco Basin is not of paramount importance nor is it a public health problem. No statistics are available so that a proper description of this disease can not be given.

Tuberculosis

Hrdlicka[81] has said of pulmonary tuberculosis in Indian tribes that "this disease which in all probability is extremely rare, if it exists at all, in the prehistoric Indians, was seldom seen before a century ago (before 1806) and is gradually becoming everywhere more common". His observations indicated further that pulmonary tuberculosis in the Indian is usually fatal within a comparative short time.

But it has been noted[82] for instance in Guatemala that tuberculosis is an important cause of death in the larger cities; it is not prevalent in small communities. The real question, as raised by Shattuck, is does tuberculosis treaten to become a major problem in Central America. If so, little has been done to combat the disease in this area. Yudice[83] applied tuberculin tests to 447 children in El Salvador and found the Pirquet test positive in 47 per cent of the subjects (children 3 to 14 years old), and those in whom it was doubtful or negative gave 21 per cent positive Mantoux tests. In the reports dealing with North American Indians, Crouch[85] found 75 per cent positive among Indians of Montana and Coleman[84] stressed the view that Navajo Indians had practically no immunity to the disease. The factors involved appear to be those of racial susceptibility, poor food, bad hygiene, and the lack of treatment of contributing causes.

164 Although we were not able to secure the incidence of pulmonary tuberculosis among the Miskito Indians, two facts seeemed apparent. *The first of these was that fever, cachexia, hemoptysis symptoms which* developed rapidly and often terminated in death were common in the younger Indians who worked in mines. The other fact is that such

[81] Hrdlicka, Ales. Smithsonian Inst. Bur. Amer. Ethnol. 1909, Bull. 42.
[82] Yudice, Luis. Salv. Med., 217, ab. 1936. (Abstract in Bol. de la Oficina Sanitaria Pan-americana, Sept. 1936, 883.)
[85] Crouch, J. H. U. S. Public Health Reports, 1932, 47, N° 38, 1907.
[84] Coleman, Nancy R. The Reservation Boarding Schools, Bull. 25, (Nov 1936), Natl. Assoc. on Indian Affairs, Inc., New York.

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clinical findings were rare among in Indians living in isolated villages and in those who subsisted on game and agriculture. This observation appeared to be common knowledge. 164

One case of tuberculous pleurisy with effusion was noted in a twenty years old boy and Bilwas and this subject was the only noted by us during the entire journey into the Coco Basin.

Malaria

In considering Central America, in 1881, Hirsch[72] has pointed out "that malarial diseases have their chief seat on the Atlantic (gulf) coast from Chagres up to Cape Gracias a Dios, and on the interior plain up to a height of 600 meters". Even though the disease occurs throughout the lowlands of Central America, there still remains today, the same striking disease problem on the eastern Atlantic areas. In fact, Malaria constitutes the major public health problem of the Miskito Coast.

Historically it is difficult to trace the presence of malaria in the New World prior to the conquest. In 1519, Cortes, Father Olmeda and Diaz had attacks of fever and similar illnesses occurred among some of their soldier[74] but the disease was mild and few deaths were attributable to it. There is no evidence that the military campaigns were handicapped by the fever. Stitt[85] in *Our Disease Inheritance from Slavery* lists tropical malaria (aestivo-autumnal) and black-water fever among the diseases introduced from Africa, and Carter[71] is "inclined to think that malaria did not exist in America prior to its discovery. It would of necessity have been introduced early by the Europeans and Negroes, and, *Anopheles* being generally present, it would have spread." On the other hand Joyeux and Sice[86] in quoting Pozo say that malaria was present in Mexico prior to Columbus.

Malaria, clinically, is protean in character and follows no given set of rules. The contributing factors are many. These are the species of parasites and their biological properties, the severity of infection, the age and race of the patient, his resistance to the disease, the effects of relapse, the kinds and amounts of therapy used and the important aspects of intracurrent, recurrent and terminal infections.[87] The di-

[85] Stitt, E. R. U. S. Naval Med. Bull. 1928, 26, 801-833.

[86] Joyeux, C. and Sice, A. Precis de Medicine Coloniale, 1937, Masson et Cie. Paris.

[87] Cannon, P. R. Some Pathologic aspects of human malaria. Symposium on Human Malaria (Ed.: Moulton) F. R. 1941, American Association for the advancement of Science, Washington.)

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[64] sease debilitates the population, reduces the activity and energy of the workers, depresses the intelligence of the children and diminishes fecundity. Since the Miskito coast abounds in mosquitoes especially those that carry the disease, it is only reasonable that malaria constitutes a major public health problem of the area.

In the Coco Basin, most of the inhabitants are either in the throes of malaria, in a period of remission or have had the disease: the exact status being difficult to differentiate. A swelling of the spleen, anemia, fever are most commonly attributed to malaria *(Wrih)*. For malarial [757] fevers the bark of certain trees are administered, particularly copalchi *(Cinchona sp.)* The stricken person is enveloped in *tunis* blankets with hot stones placed at his feet, forthwith he is often taken to the river and given a cold bath.

The high incidence of malaria is due to two reasons, the first being the large numbers of anopheline mosquitoes capable of transmitting the disease and secondly the numerous sources of host reservoirs for the parasite. Thus the infected and the infectors are numerous. The higher death rates (impression) occur among the very young and the aged. At San Carlos the death rate from malaria, between the ages of 2 to 10 years of age, is approximately 12 per cent. Most of the [165] aged, we were told, died of fever and the older people on occasion sing this chant:

[539] *"The fever returns and I shall die. I drink medicine put it on my body. The fever will kill me and I shall die. The medicine does not help me. I have been good to my family. I have had the fevers. This time it (the fever) will take me."*

[122] Our investigations were primarily directed to children because they, not being at work, were easier to secure and examine and it was easier to determine exactly the incidence of autochthonous malaria in each locality. Furthermore the children rarely leave the community and among them are fewer imported cases. However certain of the older people were examined and these are included in this report.

Children according to Brumpt[88] may be considered as a reservoir of the disease. If such is the case, then, San Carlos community becomes an ideal location for the preservation and increase of the disease. The possible reason for the lower incidence of malaria at Saulpaca is that within a few miles of this community Dr. David Thaeler maintains his clinic and hospital. Thaeler has furthermore been instrumental in teaching the people the principles of swamp drainage and malaria control. It would be reasonable to expect that in

[88] Brumpt. E. Precis de Parasitologie, 4th ed., 1927, Paris.

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Combined results of the malarial survey at Saulpaca (Zapuca) and San Carlos

Age	*Total N° of Persons*	*Spleen examination Positive Splenomegaly*		*Positive Blood smear for parasites*	
Years		*Saulpaca*	*San Carlos*	*Saulpaca*	*San Carlos*
0-1	40	0	11	6	10
2-4	46	2	15	13	17
5-9	128	3	52	46	55
10-14	80	2	34	27	36
15-19	41	2	18	14	20
50-54	34	0	8	8	9

the proximity of Bilwas Karma where certain public health measures have been introduced to expect a decreased incidence of disease. However the problem of clinical malaria remains a challenge and suppressive measures with atabrine or similar drugs may do much for these communities; the use of effective insect control with modern insecticides may play a major role in the future village control of insect borne disease. From the values given in the examination for malaria it is obvious that the disease constitutes the mayor health problem of the area. At Waspam, Bilwas Karma, the following mosquitoes were collected by our party, these were: *Anopheles albimanus, A. albitarsis, A. aquasalis, A. argyritaris, A. parapunctipennis, A. pseudopunctipennis,* (several varieties), *A. vestitipennis, and A. crucians* (reported to be collected by Kumm). *A. albimanus* was found in great numbers and is probably the principal transmitter of malaria. This species is found in humid tropical climates and its breeding places are in the swamps exposed to the sun. However it has been known to exist at altitudes of 1350 meters (Guatemala City) and is the most common vector.

Syphilis

Hrdlicka[89] has pointed out that there is no substantial evidence of precolumbian syphilis. On the other hand Williams and Wakefield, Dellinger and Camp[90] regard the conclusions of their studies as being sufficient to substantiate the view that syphilis was endemic in North America prior to European contacts. Regardless of controversy, sy-

[89] Hrdlicka, A. Disease, medicine and surgery among American aborigines (Geo. M. Kober Lecture). Jour. Amer. Med. Assoc. 1932, 99, 1661.

[90] Wakefield, E. G. Dellinger, S. C. and Camp, J. D., Study of osseous remains of "mound builders" of eastern Arkansas. Amer. Jour. Med. Sciences, 1937, 193, 418.

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phylis, today among Indians, is a disease that deserves further study. Dr. Mitchell Frank[91] has repeatedly stated that many cases with positive serologic evidence do not show clinical manifestations of syphilis nor is there anything which could he construed to indicate syphilis in the history. He points out furthermore that some of these cases on treatment have changes in serological findings but others do not. He has endeavored to perform all of precipitation — flocculation was well as the modifications of the Wasserman reactions and he is not satisfied with the status of this subject among Indians. Lynwalter[92] in 1923, in a study of Pueblo Indians found that 31 per cent had serologic evidence of syphilis and Dr. Frank does not believe that all these subjects were endowed with the disease. Plant[93] in South Dakota found serologic positives in Indians in 10.9 per cent of the men and 7.3 per cent of the women; Clarke[94] in New Mexico showed a serologic case rate of 1.5 for Indian males and 2.3 for Indian females: Dunham, Aberle, Farquhar and D'Amico[95] stated that positive serologic evidence was present in 2 per cent of the Indian children; Mountin and Townsend[96] report on incidence of 6.6 per cent among Indians studies. Pierce[97] has stated that there is something peculiar to the results obtained with precipitation flocculation tests among Indians and that the Wasserman reaction may be involved as well. Other considerations are the changing nature of the disease itself as exists over a period of years within a community and the effects of interracial marriages.

With regard to syphilis in Central Nicaragua, Rosenfeld[90] in his report stated "syphilis too is apparently very prevalent, several cases suggesting congenital and central nervous infections having been observed". It was, however, our impression that syphilis when present existed only in certain communities and rarely in others. Although there was no opportunity to perform routine serological testing, the clinical evidence of the disease was rare in all of the small

91 Frank, Mitchell, Senior Physician, United Pueblos Agency, 1943, personal communication.

92 From the Office of Indian Affairs, Washington, D. C. 1923.

93 Plant, F. Paralysestudien bei Negern u. Indianern. 1926, Berlin.

94 Clarke, W. Sangre impura in Mora: study of syphilis and certain other diseases in population of Mora County, New Mexico. Ann. of Int. Med. 1934, 7, 1936.

95 Dunham, E. C., Aberle, S. D., Farquhar, L. and D'Amico, M. Physical status of 219 Pueblo Indian children. Amer. Jour. Dis. Children, 1937, 53, 739-49.

96 Mountin, J. W., and Townsend, J. G. Treas. Dept. Pub. Health Service Bull. 1936, Bull. 223 (Feb).

97 Pierce, L. F. Personal communication, 1943.

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villages on the Coco River. In and around Waspam, San Carlos, and Bilwas Karma several cases were seen which appeared to have the stigmata of the disease. Dr. Daniel F. Molloy of the Rockefeller Foundation once informed Dr. George Shattuck [52] that yaws in Honduras and in Nicaragua occurred in "nests". It was our impression that the same can be said for syphilis. Several cases were seen in and about Bilwas that were being treated and although the disease does not present itself as a major Public Health problem within the Coco Basin it is important that it be treated since there is every likelihood that it will spread.

Yaws

Yaws is a common disease in the tropic regions of Central America and it is often seen in the subjects of the Coco Basin. There appears to be some evidence that Yaws was an ancient disease in the Americas. Hirsch [72] and Shattuck [52] agree that yaws was an importation from Africa. In a survey of a hundred patients as San Carlos nine of them yaws, three of the subjects were boys between the ages of 10 and 18 who had the typical secondary eruption of yaws. The other six patients had a mixture of annular tertiary lesions and chronic eruptions. Treponema was demonstrated in four of the patients. Although no formal survey was undertaken, Dr. Thaeler and others[98] had the impression that the disease was common in the area. The treatment of the subjects with mapharsen and bismuth salicylate results in a dramatic response, and at the end of the third weekly injection most of the lesions had disappeared. It would appear to us that a definite program could be established with regard to the treatment of yaws wherein a sustained effort in a field project coud accomplish the treatment of the majority of the cases within a short period of time. Thus a team could enter into a territory and make a definite tour with a view of treating yaws. Although the disease would probably not be eliminated by such a measure it would no doubt be suppressed in its spread to a where it might considered a minor public health problem.

Pinta

The disease pinta is characterized by changes in pigmentation as a result of *Treponema Carateum* infection. Is is presumed to be of

[98] Rosenfeld, L. in his survey of March, 1943 found among 200 subjects at Raiti and San Carlos, 26 of them with yaws and 18 of them with Pinta and 2 with both diseases combined.

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pre-columbian origin. The disease was found to occur in 10 per cent of the population examined, some villages having more of the disease than others. Aside from discoloration of the skin no other symptoms could be found and it appeared to have little effect on the body economy of an individual. However, many persons were conscious of the discoloration, felt shy because of it and presumed themselves to be unclean. The disease was common in certain families and not in others though there seems to be no evidence for congenital transmission[99]. So far little or no treatment for the disease has taken place in this area.

Dysentery

If by dysentery we mean infectious diarrhea then this disease is not only prevalent in the tropics but it is associated by high morbidity and mortality. And since it is epidemic in quality it is bacterial in origin.* However it must not be forgotten that dysentery is a loose term denoting mainly a symptom complex. As such the disease can be caused by amoeba, by the ciliate *Balantidium coli*, by malaria (P. falciparum), by certain worms, and by *giardia*. The two most common types of dysentery are bacillary and amoebic and of these two the former is our primary concern.

Bacillary dysentery is common throughout the year in the Coco River basin but has its greatest epidemic quality during the beginning and end of the rainy seasons. The childhood mortality rate from the disease although not exact takes a toll of approximately ten per cent of the children afflicted by it. As far as could de determined with limited equipment the common etiological agent is *Shigella paradysenteriae Flexner*, an organism utilizing glucose, mannite, but not lactose or dulcite.

The disease occurs chiefly in the larger villages; in the smaller villages it may be rare or have never occured. This is of interest from an epidemiological point of view since in some of the isolated small villages the carrier or the source of the organism is not available. In the larger villages, an example of which is San Carlos, the disease may debilitate a third to one half the population. In our opinion, at San Carlos the disease may be traced to certain wretched latrines within the business section of the village. Some of the latrines have been erected at considerable cost; others are make-shift devices for the conveniences of their owners. Regardless of cost the screens because

[99] Mackie, T. T., Hunter, G. W. and Worth, C. B. A. Manual of tropical medicine. Philadelphia, 1945.

* Dysentery bacilli, Salmonella, Staphylococci, etc.

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of rain and humidity have eroded, the pit fills with water and the entire construction fills with flies. The dysentery epidemics at San Carlos usually begin about these latrines and extend to the periphery of the village.

Another contributing factor to the spread of dysentery is that in some areas well meaning visitors have encouraged the use of milk for children. In a territory devoid of refrigeration or adequate sterilization the use of milk should be derived from the mother's breast or directly from the cow's udder. On the other hand milk products such as cheese are less likely to be infected. Nevertheless, milk fluid serves as an excellent bacterial medium. Powdered milk might obviate such a hazard.

Drinking water in the larger villages may be considered a source of infection since water may be stored in containers not ideally suited for such a purpose or the water may be collected from the main river or other pools simply because the source is conveniently located.

The Indian customs are such as to depress the occurrence of dysentery. These customs are to drink water from clear running creeks (see map of San Carlos), and to perform their ablutions either in the large river or to dig holes for their excremata. If holes are dug in the bush they are inmediately covered up after use. The Indian, unless educated otherwise, considers the communal use of a structure such as a collecting booth for feces and urine as an evil. It would thus appear that the invading culture (Spanish American) with its convenient latrine often in juxtaposition to the latrine, has furthered the dysentery problem.

Some of the latrines observed were of such a character that even the investigators used to the inconveniences of the bush felt repelled by the utterly uninviting stench and the great scatter of soiled paper throughout the establishment. Toilet paper, in many tropical areas of high humidity, offers itself as a remarkable medium for growth of molds which renders the paper useless. Latrines built by special sanitary engineers were misused, had eroded screens and were halt filled with water. During the dry season when they were erected they were presumed to be ideal and satisfactory in every way.

If the wretched latrine is to be used, the use insecticides and disinfectants must be encouraged, otherwise dysentery will be present. The authors of this report endeavored to encourage the Indian practice of waste disposal.

Amoebic dysentery exists as far as could be determined in from 2-5 per cent of the population. Stool examinations at Waspam, revealed that 7 per cent of the adults and 2 per cent of the children had

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164 evidence of amoebic dysentery. Many of the patients were symptom free but gave clinical histories of occasional periods of cramps and blood and mucous in their stools. One person was seen in exhaustion from the chronic diarrhea of feces mingled with blood and mucous (sago-grain stool). Most of the people with the disease complain of easy exhaustion and appear to be chronically fatigued. This disease like bacillary dysentery is commonest in the larger villages where food has a greater opportunity to be contaminated by fecal matter or infected water. In isolated smaller villages the disease is rare, if ever present. The source of amoebiasis in such areas is not always simple to ascertain since many persons eat the same food and some become infected and others not. The role of carriers of the disease requires a special study which we were unable to perform.

Skin diseases

In many communities people are afflicted with tropical skin sores presumably of fungous origin. The diagnosis of the lesions is difficult, smears observed under the microscope reveal mycelia of all varieties. Certain ulcers may be of spirochaetal or bacterial etiology but we were not sufficiently specialized to assume the responsibility of a specific diagnosis. The persons in about one fourth of many communities have with some sort of mycotic lesion, in other communities skin diseases may be less in number. Needless to say there is no satisfactory method of treating the majority of such lesions. The usual lotions containing Salicylate, thymol, cooper sulfate, etc. may offer temporary improvement or increase the dermatitis. It would seem difficult to suppose that topical application of some agent would attack a mycelar structure extending into the deep tissues. It was our impression that a systematic drug was needed that would have fungicidal or fungistatic effects. Many of the natives informed the observers that lesions began as a chigger sore or as a result of an insect bite and one may speculate that fungus infection may occur in certain areas of the skin where a break in structure has occured. It is therefore recommended that sores or bites are treated with fungicidal agents providing, of course, that the agent does not in itself provoke a dermatitis.

SUMMARY OF DISEASE AMONG COCO RIVER MISKITO INDIANS:

Suggestions for amelioration

000 The salient public health problems of the Coco River Basin are

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759 rendering health service to this situation. Physicians, in general, find the territory unremunerative and as a consequence cannot be induced to venture or remain in that region. We are therefore confronted with the problem of adapting our method to the situation even though the procedure introduced may not be ideal.

For this reason Dr. Thaeler at Bilwas Karma has trained young men to act as agents for the central clinic. The men arrive at Bilwas Karma and undergo a serious series of lectures and demonstrations, then a period of internship and are forthwith prepared to carry out limited medical activities in the communities from whence they came. In this process of adaptation it is important that the trainee return to his original community, for his people know him, place trust in him, and adaption to a porgram is simplified. Furthermore the trainee is at ease with his own people, his prestige is increased and his relatives offer odequate security for his success.

164 759 The diseases in which an empirical diagnosis can be made with a medicum of success are as follows: malaria; yaws; pinta; acute dysentery (presumably bacillary); chronic weaking dysentery; (presumably protozoal or helminthic); helminthes; and skin infections. The trainee is taught mainly in terms of these major diseases, first aid and rudimentary principles of child-bearing and pediatrics are secondary. The system ordinarily employed by the Indians in first aid is not to be condemned, obstetrics and pediatrics do not constitute subjects of sufficient public health importance to this region. The trainee is taught insect control measures and the use of certain speciific drugs for the diseases just described. His medical supplies consist chiefly 278 of atabrine, oil of chenopodium, magnesium sulfate, sulfaquanidine, vioform, carbarsone, antiseptics, gentian violet pills, a few miscellaneous drugs such as aspirin and some first aid equipment. The trainee is taught to send many of the patients whom he regards as special cases to the hospital. There is a possibility that such a system may 000 succeed, particularily if the trainee or agent is brought back to Bilwas for refresher courses. The merits of the system result from one basic fact and that is that Dr. Thaeler is a well trained clinician with considerable understanding of these Indians. It seems highly important that such a program be directed only by a well qualified physician or physicians who have had special training in medicine as applied to societies of varying cultural traits. This fact has been recognized to some extent by the British in their various schools of tropical or colonial medicine and by the United Fruit Company. In other instances tropical medicine may be academically isolated from the societies who should receive the results. The mistakes made by young physicians,